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Emerson, Harrington  
The railroad  
situation

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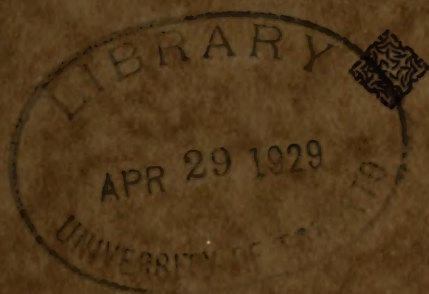


# THE RAILROAD SITUATION

*Why 30 per cent Rate Increase  
Is Not Enough*

*By*

HARRINGTON EMERSON



*Published by*

THE EMERSON ENGINEERS

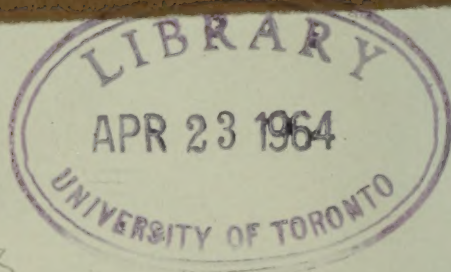
Efficiency Counselors

Harrington Emerson, Director

30 Church Street

New York





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**Page 25**, line 27. "Inherent charges" should read "Investment charges".

**Page 33.** 11th line from bottom should be \$157,000 instead of \$153,360  
6th line from bottom \$35,000 not \$33,350.

**Page 37.** Table: Obsolescence Estimates.

The following lines should be corrected:

	Average Life in years	Inventory Value	Yearly Obs.	P. C. in Value
Road	30	101,200	3,370	3.3
Accessories	16	10,400	645	6.2
(Totals)		<u>\$300,000</u>	<u>\$15,226</u>	<u>5.1</u>

Daily Obsolescence Charge \$41.71

**Page 43**, line 3. 8.3 per cent not 6.3.

**Page 45\***, line 8 from top read two to three years.

Line 17 from top read two years.

Line 18 " " " " "

Line 21 " " " " "

Line 23 " " " " "

\* Class I roads 18 months behind. II and III roads three years behind.



## ERRATA AND ADDENDA

**Frontispiece.** The load of the man is 350 pounds, that of the 12-year old boy is 80 pounds. The distance traveled is 400 miles in 20 days at a speed of two miles an hour. The photograph is copyrighted by UNDERWOOD & UNDERWOOD. Otherwise this pamphlet is not copyrighted.

**Page 15.** Last line should read "Average yearly production per worker.....\$1,480"

**Page 16.** First line should read "Country produces daily.....\$3,082"

Also the following corrections:

### Tax receipts

Income and profits.....	\$40,400
Miscellaneous .....	7,370
Spirits .....	5,694
Tobacco.....	3,210
Customs .....	2,790
Fermented liquors.....	<u>1,825</u>

Total Federal taxes.....\$ 62,569.00

Total per person..... 37.40

### Net Interest-Bearing Debt

Deducting Loans to Allies..... 234,000.00

Annual Interest Charge..... 10,530.00

Interest Charge per Person..... 6.31

**Page 19.** 2nd line from bottom \$68.90 not \$69.90  
First line from bottom \$306.37 not \$307.37

**Page 20.** Dollar signs should be shown in the first, third and fifth columns at the top of the page.

**Page 22.** First two headings over table should read "Number of Men" and "Hours of Work".

**Page 24.** First line from bottom \$306.37.  
Third line from bottom \$188.90.



## FOREWORD

On the basis of 6 per cent interest as a return on valuation the railroads in 1919 ran short \$1,984,000,000.

Further shortages impend:

The accruing shortage in 1920.

The increased price of labor and material.

The increased wage demands yet to be granted.

The loss of revenues from crop shortages.

The loss of revenues from business depression.

The increasing taxes.

This preliminary study of railroad revenues and expenses attempts to show that the loss of \$1,984,000,000 actually occurred in 1919; that an increase of revenues of \$1,000,000,000 is only half the required amount; that the difficulties of making up more than a small part of the other \$1,000,000,000 shortage by increased efficiency are very great. To increase efficiency requires time, and it can only be made effective in certain definite and limited directions which this study also indicates.







## PREFACE

There is too much printed matter now. It is inexcusable to add to it unless it is worth while.

We learn chiefly by our own experiences, nevertheless there is much to be gleaned from others who have passed over the same road. Mark Twain in "Life on the Mississippi" tells how the Mississippi pilots left information for each other at certain points on the river. The pilot going up could thus learn the latest as to the stages and channels of the river a thousand miles above.

It is in this spirit that I offer what I have learned to other railroad men. They have taught me so much in the last forty years that there is welcome obligation to pass on to those younger anything of value that has become mine.

Kipling, in one of his best stories, quotes the old Hindu wisdom that a man should be a learner for twenty years, a doer for twenty years, a commander for twenty years and then, if any of life is left, he is qualified to be a counselor.

Our modern life makes it necessary for a man always to be a learner, and after he has become a doer, to continue always to be a doer, even though he has become a commander, and to continue to be a commander even after he is qualified to counsel. James J. Hill never ceased to be all.

I have had an intensely active and interesting life, during which I was never given an opportunity to stop learning, to stop doing, to stop commanding.

At a very early age I was thrown into new situations and surroundings for which no previous experience had fitted me.



After spending six years in teaching to the enthusiastic young on the American frontier what I had learned in the schools and among the peoples of the Old World, I was fortunately thrown into railroad work under a number of eminent railroad specialists and executives. With the exception of one year I have been continually in railroad service for 40 years. I have located and surveyed railroad routes in new and as yet unsettled regions. I have been affiliated with all departments. I have learned from my great teachers. These experiences are my justification for offering counsel as to railroad problems.

The purpose of this booklet is, in not too serious a way, to make available to the great company of railroad executives and workers in the United States certain exceedingly important and interesting facts and also to outline certain theories which I think are necessary deductions from the facts.

The facts, derived largely from the records of the Interstate Commerce Commission and from the admirable and up-to-date records of the Bureau of Railway Economics, I shall try to present in a way easy to grasp and understand. With the facts before both my reader and me, I shall suggest certain conclusions. He is under no obligation to agree with me. He may draw different and more valuable conclusions from the same facts.

I draw the conclusions I do because I hold certain convictions. These convictions I shall also state.

I believe that just as life exists on account of certain biological laws, so also is civilization built up on the foundations of a few great moralities which transportation activities, so large a part in our civilized life, must also observe.

I believe that these moralities must be enforced, not by bureaucrats, but by great leaders, endowed with the qualities that in all ages have characterized great leaders. I believe that the fundamentals of organization have not been invented by men, but underlie the development of all the universe and particularly govern all life, plant and animal.



I believe further that just as the wheel flanges, the swivel trucks, the elevated outside rail on the curve, the spiked rails on the ties, embedded in the leveled ballast, keep the trains on their course, so also a few, a very few practical principles systematically applied will enable us to eliminate the errors that may make industrial wrecks of great enterprises, of great communities, of great civilizations.

We are still too near the great World War to grasp all its lessons. The one error, a very old one, of believing that Might is Right, instead of being convinced that Right is Might, has given the civilization of the Western World a blow from which it is not yet certain that it will recover.

Transportation is one of the main props of our civilization; it is not free from or above the eternal laws. Expedients are admirable only when they violate no principle.

I hope therefore that my readers will find more in this booklet than mere facts. I hope they will find clear statements of all important principles and I hope also they will find practical suggestions as to how to eliminate preventable wastes, losses, extravagances in railroad operation.

The facts show that our railroads have for many years been operating at a loss, a loss unfairly placed on the investor, on the railroad worker, on communities served by the railroads.

HARRINGTON EMERSON.

New York, May, 1920.





### TRANSPORTATION IN CHINA

The type of Human Degradation which the Railroads  
have eliminated in this country



## CHAPTER I.

Receiving as they do special privileges from federal, state and municipal governments,

(1) Railroads are under obligation to give the public the quantity and quality of service it needs and wants.

(2) Railroads are under obligation to give a service that to a reasonably high degree conforms to the great moralities on which civilization rests.

But also the various governing bodies are under equally great obligation to authorize such rates as will provide the service wanted, provide for the observance of the moralities and maintain the credit of the railroads, a maintenance of credit based on fair valuation.

To summarize:

There is obligation to give service.

There is obligation to observe the moralities.

There is obligation to maintain the value of investments.

Of all the great divisions of human activity in the United States the railroads have suffered most during and since the war. Agricultural products have risen to three times their pre-war prices. Manufacturers have reaped golden profits. There has been an orgy of buying at high prices from the merchandizers. All these were directly benefitted by the war. Our food went abroad, our manufacturers sold abroad, but the railroads stayed at home and were not even permitted to manage their own business, and only to a small degree to increase rates.

The theory was promulgated that men with a minimum of practical railroad experience could be given



jurisdiction over the great railroad companies and make them a success at a time when unusual skill was required.

The owners, the managers, the employes, the public and the government, to put them in the order of their importance, are now engaged in unscrambling the eggs.

Railroad executives and managers have more serious difficulties than executives in most other lines of activities.

They share with other executives the obligation to serve their patrons, to earn returns on the values used, to solve labor problems, to use equipment and materials economically, to combine values, materials and workers into a productive whole.

But in addition they have the problem of resisting confiscatory attacks by the collective public, whether represented by municipalities, state or Federal governments.

Ours is a continental country. England is a sea-girt country. Our railroads do for us what her ships do for England. British ships are subjected to severe regulations as to safety, but rates are not dictated to them as they are to our railways.

This essay will, however, only indirectly touch on labor and public control problems. Its purpose is to state clearly the present situation, to ask its consideration by all, hoping that all concerned will give assistance.

Steam railroads are of very great importance to all. It is alike of importance to their owners, to their managers, to their employes, to their patrons and to the government that they should be efficient and prosperous.

Because the railroads have obtained their charters, their commissions, giving them special powers, from the public, they, like commissioned officers in the army or navy, are under great obligations to the public, but also, as likewise with commissioned public



officers, the public is under great obligation to the railroads.

Right-minded men deplored that the Boston police should go on strike, but they also deplored that the well-founded grievances of the police had not received adequate consideration.

Similarly, because so much is at stake and because of their special privileges the railroads may not refuse to serve the public, but the public must in turn be fair to the roads.

I learned my railroad ethics practically, not theoretically. In the winter of 1900-1901 I floundered five times over the White Pass in Alaska between Skagway and the headwaters of the Yukon. I made the trip once on foot, once with dog team, three times with horse and sled, but the sixth time I went comfortably in a railroad car.

With the loaded horse sled, in spite of long chains wrapped around both runners, I nearly followed my predecessor over a precipice. On foot I sank to my waist in slush water above the ice and under the snow. It was ten degrees below zero and I had ten miles to go. When I drove dogs, in the early morning they chewed up their harness almost as fast as I could mend it. I had to use my bare hands and that morning it was 30 degrees below zero. I know all the joys and danger and expense of primitive methods of travel.

When at last the railroad was built I most cheerfully paid \$10 to ride in two hours 40 miles on a comfortable, safe road. Twenty-five cents a mile may seem dear to people born where railroads are old, but it seemed cheap to me, since each previous trip had cost me nearly one dollar a mile, and not forgetting that the accident insurance company cancelled my \$70,000 policy when it heard that I was wintering between Skagway and Lake Bennett, and, all things considered, I did not blame it.

I had been charged \$0.08 a pound by the packers to carry my supplies 40 miles. I sent freight by the



railroad three times as far with a 1,000-mile sea trip in addition for \$0.03 a pound.

The illustration shows a Chinese packer and his boy of twelve. The father is carrying a load of 350 pounds and the child carries 80 pounds. They make a trip of 400 miles in 20 days and formerly used to earn \$0.10 a day.

This is the kind of human degradation the railroads have put an end to, because this kind of freighting cost at least \$0.03 a ton mile and our railroads carry for less than \$0.01 a ton mile, owing to the fact that we have substituted materials and the gigantic machine and placed them under the supervision of less motive but more mental and vital men.

Lowest, just and economical expenses of conducting the railroads exceed the allowed past and prospective revenues.

How much railroad revenues have in the past and will in the immediate future fall below costs must be estimated by each for himself. Legitimate differences of opinion may occur at every step. It is, however, desirable to start with a clear conception of the whole situation as well as with an earnest desire to be fair and to co-ordinate.

The higher we attain in industrial competence, the lower the rates can be. The lower the industrial competence insisted on by the public, the higher must be the rates.

In fairness the public cannot set for the railroads a higher standard of excellence than this same public itself sets in its municipal, state and Federal bodies, which propose to dictate rates.

There is a peculiar moral obligation resting on elected and appointed public officials to administer economically and efficiently the trust given them. They have no obligation to earn returns. Their sole obligations are to be honest and competent. The average level of public incompetence was illustrated



during the World War when many of those in authority procrastinated and wasted in every direction.

I advocate principles rather than expedients, because there is no wisdom or skill available to foresee what may occur.

- (1) The volume of traffic may increase or lessen.
- (2) The average rate of wages per hour may rise or fall.
- (3) The cost of essential materials may rise or fall.
- (4) The interest rate and other investment charges may increase or decrease.

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## CHAPTER II.

### **Who Can Understand Billions?**

Many persons own automobiles. The total registration this year covers over 7,000,000. It is not so difficult to understand a single automobile. It costs so much to buy it, it is obsolete in a few years, it is taxed and licensed, probably insurance is paid. A number of fancy betterments, accessories, are installed, from anti-thief locks to flower holders. There are garage rents.

These are the investment charges. In addition there are the material charges for gas, for lubricants, for tires, for repair parts, then come the personnel charges for chauffeur, for washing, for repairs.

The automobile is such a little thing that we can fairly well understand it. A manager could understand a railroad much better if he had only one locomotive, a short road of 3.6 miles, a few cars and a few employes.

An accountant could check up the costs of operating a single automobile for a day more clearly than he could the costs of operating 7,000,000 automobiles



for a whole year; he could check up one locomotive for a single day better than he could 64,100 locomotives for a year.

Therefore to obtain a firm grasp on railroad operations I reduce the scale.

I bring it down where the human mind can take it in.

That we cannot understand immense figures will be illustrated by a few tests.

Look at the moon. You see that it is round, looks like a plate, but as you watch the crescent grow to quarter, to half, to three-quarters, you realize that the black and white halves of a ball, slowly turned, would alone produce these phases.

Any thinking person knows that the moon is a ball, but until a few hundred years ago not one person in a thousand million knew that the earth under their feet was a ball. None of us would know it today unless told. Columbus, who believed it, was called crazy.

What is the shortest distance from Panama to Manila? Without a map no one can tell. Even with a map no one can tell. Try it. But take a globe, even a little one, the size of a baseball, and this little thing we hold in our hands, that we can see and turn all at once, answers our question.

The shortest route from Panama to Manila is through the canal to Galveston, by sea, thence by rail via Denver to Seattle, then by sea again to Dutch Harbor, Alaska, past the westward island of Attu to Yokohama and then on to Manila. The distance is a little over 10,000 miles. Also the globe shows that the nearest land in North America to New Zealand is the tip of the Alaskan peninsula, and that Seattle is nearer to Great Britain than is Galveston, that Norway is nearer Alaska than to New York.

How high is the Woolworth building or any other tall building? How high are the clouds you see? Your guesses will be poor, yet you can very accurately guess the height of a man you meet. The



clouds are too big for you; the man is your own class.

Here is a puzzle question. You, as a railroad man, are acquainted with locomotive driver tires. They have to fit tight. Let us assume that the earth is 24,000 miles around at the equator and smooth as a billiard ball. We put a steel tire around it, tight fit. We then cut the tire and insert a piece one foot long. The tire is now 24,000 miles and one foot around. How thick would the shim have to be, the piece put under the tire all around, to make it tight again? You ought to be able to give the answer closely in ten seconds. If you can't and you do not want to take the time to figure it out with pencil and paper you will find the answer somewhere further on in the booklet.

Here is another one to be answered quickly:

1,250,000  
12,500,000  
125,000,000  
1,250,000,000  
12,500,000,000

Which one of these figures is approximately the distance in feet around the earth at the equator? Can you instantly and readily tell by looking? Be a sport. Make a quick choice. Put your pencil down and figure later. Yet you would instantly notice a man seven feet tall or four feet short. If asked to guess you would not be far wrong as to the height of either.

It is not possible for anyone to understand the real meaning of the figures that follow. A noted educator told me that no child could understand what was beyond his experience and that is the reason the word education means to draw out, not to put in.

1919

Total Railway Capital.....	\$19,230,000,000
Total ton miles.....	402,000,000,000
Total passenger miles.....	48,700,000,000
Total locomotive miles, Class I.....	1,754,000,000
Total Revenues .....	\$5,184,230,244
Total Salaries and Wages.....	\$2,810,000,000



Different jobs in year, estimates.....	2,730,000,000
Total materials used .....	\$1,609,000,000
Total investment Maintenance charges.....	\$4,419,998,750
Total Freight cars.....	2,300,000
Total Employees .....	1,900,000

I cannot grasp these stupendous figures, and to help myself I have had to simplify them.

It is easier to find one's way with a good automobile road map than it is to run up and down unknown roads trying to get somewhere.

How simple everything becomes if we only make it small enough.

Because the scale is smaller, a woman, a house mother, knows the details of her business better than a man knows his business.

A mother knows the birthdays, ages, sex, color of eyes and hair, size, health, disposition of her different children, she knows each room in her house, and each article of furniture in each room, she knows the contents of her bureau and of her pantry. There may be exceptions, but most women do. The problem is not beyond her comprehension and grasp.

We are told that Solomon had 700 wives, probably a couple of thousand children. They lived in different apartments. He could not have known their names, or recognized them, unless he had the special skill of the hotel clerk. When they were sick, either individually or in groups, he proved a very poor caretaker.

(If the man reported to be the wisest in the world fell down badly in the administration of his household, how much less is a man really able to grasp a business like that of the railroads and to coordinate millions of dollars of equipment, millions of dollars of materials and thousands of employees.)

Let us now take some real railroad reports and reduce the scale from that of 64,100 locomotives working 365 days to one locomotive working one day. I obtain a much clearer idea from the small scale than from the full size.



## CHAPTER III.

### **The Revised Scale and the Imaginary Manager. The Inventory of the Country.**

There are 64,100 locomotives in the Class I railways, and if I multiply the locomotives by 365 I obtain the locomotive days, 23,400,000. To obtain the results for one locomotive I divide by 64,100. To obtain the accounts for one locomotive day I divide the yearly figures for the whole United States for Class I railroads by 23,400,000.

The imaginary country will be only  $\frac{1}{64,100}$  as large as the United States and everything in it should be multiplied by 64,100 to equal the same thing in the United States.

Before finding out the railroad situation in this little country let us assume that an excellent railroad Manager is appointed to take charge of and rehabilitate the railroad system much upset, as is also the country by a great war shortly before ended.

This Manager would first of all size up the general situation, in order to find out on what physical, vital and moral bases the railroad property rests.

The country in which his line is the only steam railroad:

#### **PHYSICAL STATISTICS**

Area in square miles .....	47
Acres .....	30,000
Acres cultivated .....	4,700
Total net valuation of country.....	\$4,000,000
Total number of inhabitants.....	1,670
Average wealth per person.....	\$ 2,500
Yearly production .....	\$1,125,000
Yearly production per inhabitant.....	\$ 674
Total number of workers.....	760
Average wealth per worker.....	\$ 1,480



Daily production per locomotive.....	\$ 3,082
Persons reporting income—	
\$1,000 to \$2,000.....	25
2,000 to 3,000.....	13
3,000 to 5,000.....	9
5,000 to 10,000.....	4
10,000 to 25,000.....	2
Above \$25,000 .....	1
	<hr/> 54
Total income reported above \$3,000.....	\$213,000
Commercial failures, in 10 years.....	1
Net liability from commercial failures per year .....	\$ 1,000
Fire losses yearly.....	\$ 5,000
Exports and imports yearly.....	\$ 160,000
Tax receipts—	
Customs .....	\$ 2,790.00
Spirits .....	\$ 5,694.00
Fermented Liquors .....	\$ 1,825.00
Tobacco .....	\$ 321.00
Income Tax .....	\$19,400.00
Miscellaneous .....	\$40,000.00
Total Federal Taxes.....	\$ 70,030.00
Taxes per person .....	\$ 42.00
Interest bearing debt.....	\$167,000.00
Annual interest charge.....	\$ 7,515.00
Interest charge per person.....	\$ 4.50

## VITAL STATISTICS

### Race

White .....	1,482
Colored .....	180
Indian .....	5
Asiatic .....	3
	<hr/>
Total .....	1,670

### Sex and Age

Men over 21 years.....	418
Women over 21 years .....	397
Children under 21 years.....	855
	<hr/>
Total .....	1,670

### Family Relations

Marriages yearly .....	71
Divorces .....	2
Births .....	42
Deaths .....	24

### Decadents

Insane .....	4
Criminals in jail .....	2
Paupers in alms houses.....	2



## Industrial Relations

	Per cent.	Persons
Producing—farming, mining, forestry, fishing .....	42	318
Manufacture .....	25	190
Transportation—railroads .....	4	30
Transportation—other .....	5	37
Trade and merchandizing .....	10	75
<hr/>		
Total Material Division.....	86	650
Professional Service .....	3.8	27
Domestic and manual.....	8.8	66
Ethical Service, public, co-ordination, aptitude, entertainment, hygiene, education, competence	2.4	17
<hr/>		
Total personnel .....	14	110
<hr/>		
Grand total .....	100	760

From considering this country we learn much. It is evident that with 330 families and only 66 persons in all engaged in any form of domestic and manual service, only one family in five can have any helper in the home. It also appears that about 86 per cent. are busy with materials and only about 14 per cent. busy with personal service.

We begin to understand why this age is called a materialistic age. How can it be otherwise, when six out of seven make their living through materials?

Another matter to notice is that any radical change in the percentages is sure to cause trouble. We need 42 per cent. of our workers to produce food and other raw products for the rest of us.

Yet all these divisions are trying at the present time to expand at each other's expense. The farming industry is the greatest sufferer.

What is to be done when a new industry develops? How is it to find workers?

In the last 15 years three great new industries have sprung up—automobiles, which have appropriated 16 workers; the moving picture industry and the phonographs. How many they have absorbed I do not know. In the meantime, there used to come yearly to this little country 16 immigrants, enough to replace in



four years all our laborers, some of whom were gradually moving up.

These are no longer coming.

Also the adoption of the eight-hour work day has decreased output nearly 20 per cent., so that 162 more workers are needed for the same output. There is a general scramble for workers, not laborers only, but for any kind of worker. The farmer suffers most, for the great bulk of the producers are farmers.

The local Henry Ford is trying to put out 10 farm tractors each year. It is but a drop in the bucket, but it will ultimately help the farm situation.

Everybody says we need more production, but what we need more is a readjustment. That increased production which entices workers away from other divisions instead of increasing the competence of the workers within the division adds to the difficulties.

## MORAL CONDITIONS

This little country, the richest in the world, the most fortunate in the world, was also as yet less contaminated by the destructive theories of those who believe that there are no opportunities left in the world, and that if any one has saved anything, gained any prominence by industry, skill, invention, he must have stolen it from those less strenuous than himself; people whose theories would not be tolerated by a self-respecting fox, musk ox, raven, orang, humming bird or honey bee, not to speak of the ants.

This community, even if not very logically, clearly and strenuously, believed and practiced the great moralities on which civilization is founded. These moralities are:

That aptitude should have opportunity.

That all should be co-ordinated and co-operate for the common good.

That public and social hygiene are essential and obligatory.



That pleasure and joy are as essential to life as toil and rest.

That "all things whatsoever ye would that men should do to you, do ye even so to them; for this is the law."

That what is in each man should be developed through education and that he should also acquire general and special skill.

That industrial competence should at all times be obligatory; that all needless losses and wastes and leaks should be eliminated.

These are the seven moralities of civilization which few are perhaps willing fully to accept, but which none can deny. It is these moralities which were needed as the basis for a League of Nations.

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## CHAPTER IV.

Having taken the inventory of the country where he was to operate a railroad, as to its physical wealth and possibilities of growth, having taken also a vital and moral inventory of its inhabitants, the General Manager next investigated the railroad he was to manage.

He must first analyze all his operations from the accounting divisions of maintenance and operation to the basic divisions of machines, men and materials.

### **COSTS OF OPERATION** **Per Locomotive Day (1919)**

		Per cent.
Equipment Costs .....	\$117.47	38.3
Personnel Costs .....	\$120.00	39.2
Material Costs .....	\$ 69.90	22.5
	<hr/>	<hr/>
	\$307.37	100



Comparison with 1914 shows what has occurred:

	1914	p. c.	1919	p. c.	Increase
Equipment Costs.....	77	46.7	117	38.3	52
Personnel Costs.....	55	33.3	120	39.2	118
Material Costs.....	33	20	70	22.5	103
	<hr/> 165	<hr/> 100	<hr/> 307	<hr/> 100	<hr/> 85.7

The trend is unfortunate and backwards.

The railroads are not responsible for the drop in the value of money due to vast issues of fiat money during the war, issues that are largely responsible for the 85.7 per cent. increase in cost. What is more serious is that whereas equipment and materials in 1914 contributed two-thirds to railroad performance and man labor contributed only one-third, in 1919 equipment and materials dropped to 60 per cent. and the man element increased from 33.3 to 40 per cent., a 20 per cent. increase in personnel cost at a time when men were scarce.

The two sore spots in American railroading are:

- (1) The excessive equipment in proportion to revenue.
- (2) The very large proportion of personnel service.

This is the age of machines and of materials, not of back-breaking man power. Civilization is evidenced by better equipment, better materials, better supervision of both, better co-ordination of all, but less manual labor. The chauffeur, not the coolie packer; the steam shovel, not the man with the pick and shovel; the marine engine, not the galley slave or the sailor; the concrete mixer or structural steel worker, not the stonecutter or the bricklayer; the printing press, not the copiest; the power loom, not the weaver.

The world cannot spare more men for transportation; it needs them to supervise production. We do not want men to become competitors of machines; we want them to supervise machines, bigger and faster and more automatic machines.



When economy and efficiency of operation are the aims, each one of these contributing elements must be separately analyzed.

### THE PHYSICAL INVENTORY

(For details see Appendix I)

A tentative inventory and valuation for Class I roads.  
Line, 3.6 miles. Track, 5.7 miles.

Item	Per locomotive
Road .....	\$112,000
Accessories .....	\$ 5,000
Buildings .....	\$ 20,000
Total fixed .....	\$137,000
Shop and work equipment.....	\$ 3,300
1 locomotive .....	\$ 45,000
1 coach .....	\$ 20,000
36.4 freight cars.....	\$ 80,000
Stores and supplies.....	\$ 9,900
Working capital .....	\$ 4,800
Total movable .....	\$163,000
Grand total .....	\$300,000
Cost per mile of line.....	\$ 83,000
Cost per mile of track.....	\$ 52,600

Appendix III. gives the comparative valuations for 1913 per mile of line in other countries.

This amount of property, whether operated or not, causes charges which have to be paid regularly or the property may be confiscated, may dwindle in value through fires or obsolescence.

### EQUIPMENT CHARGES

	Yearly	Daily	Per cent. on Valua- tion	Per cent. of Charges
1. Taxes .....	\$3,107.55	\$8.51	1.04	7.20
2. Insurance (charged to operation).....				
3. Uncollectible rail- road revenues .....	14.31	.04	.....	.03
4. Rentals—				
Equipment .....	508.55	1.40	.17	1.2
Joint facilities.....	245.52	.67	.08	.57
5. Obsolescence (not depreciation) .....	15,000.00	41.09	5.	35.



6. Unpaying better- ments .....	6,000.00	16.44	2.	14.
7. Interest .....	18,000.00	49.32	6.	42.
	<u>\$42,879.00</u>	<u>\$117.47</u>	<u>14.29</u>	<u>100.</u>

(For discussion of these items see appendix III.)

The fixed charges, which it would not be possible to lower, which in fact were likely to grow, amounted in 1919 to:

\$117.47 daily.

### INVENTORY OF PERSONNEL 30 Men for Each Locomotive.

	Number Hours of Work		Hourly Rate of Pay	Total Daily Pay
General and division officers	.3	7.8	\$1.26	\$ 2.95
Traffic .....	.1	7.	.79	.55
Office men .....	3.5	7.1	.52	12.95
Maintenance way and struc- tures .....	6.	7.3	.40	17.50
Maintenance equipment.....	10.	6.3	.60	37.60
Despatchers .....	1.	7.5	.65	4.95
Station employees.....	2.	7.2	.45	6.45
Train employees .....	5.	7.5	.693	26.
Other transportation em- ployees .....	1.5	6.6	.60	5.95
Yard employees .....	.3	7.2	.65	1.40
General .....	.3	7.3	.39	.85
	<u>30.</u>			<u>\$117.15</u>
Legal services, pensions, damages to persons.....				\$ 2.85
Total personnel expense.....				<u>\$120.00</u>

### MATERIALS

What materials does it take to maintain and to operate the road, the locomotive and the cars?

#### LIST OF PRINCIPAL MATERIALS

		Per cent.
Fuel tons, 6.3 at \$3.60.....	\$22.70	33.
Locomotive repair parts .....	12.00	17.4
Ties, 3 at \$1.16.....	3.48	5.1
Track supplies .....	2.80	4.1
Stationery .....	1.40	2.
Track material .....	1.71	2.5
Rail renewals .....	1.14	1.7
Water .....	1.34	2
Miscellaneous operations .....	1.89	2.7



Shop machinery and tools .....	1.15	1.7
Ballast .....	.58	.8
Other locomotive supplies.....	.39	.5
Lubricants .....	.36	.5
	<hr/>	<hr/>
	\$50.94	74.
All other materials.....	17.96	26.
	<hr/>	<hr/>
	\$68.90	100.

Total of daily expenses are therefore, as shown above, \$306.37.

These three productive elements are to be coordinated so as to carry freight and passengers and other traffic, the revenues from such traffic to pay all the expenses.

Two points of view arise:

(1) How much traffic ought such a combination to take care of?

(2) What is the traffic that is actually available?

### **More Traffic Can Be Handled**

It is quite possible that the combination could take care of far more traffic than is actually at present offered. If this is the case with too large a combination on hand, the efforts of all railroad executives should be concentrated on increasing the traffic until it absorbs the capacity of the road.

If, on the other hand, there is no immediate outlook of increasing the traffic, then the executive must concentrate on operating the oversized railroad as economically as possible.

A locomotive should run at least 100 miles a day in 15 hours, an average speed of 14 miles an hour. It actually runs 75.4 miles in 7.5 hours at an average speed of 10.1 miles per hour.

The 36.4 cars ought to travel 35 miles each day with an average load of 25 tons, a total of 32,000 ton miles. The actual tons one mile are 18,200.

As some roads are far above this average, it might be possible for other roads to do better.



This is, however, a hypothetical question, since increased traffic cannot be created at will by the railroads. Volume of traffic depends on the general condition of the country and of its inhabitants.

The immediately practical question is the volume of traffic actually available and the revenues it produces.

APPROXIMATE PERCENTAGES OF TONNAGE  
IN 1919  
(1917 reports)

Production.	Per cent
Products of mines .....	53.5
Products of agriculture .....	9.6
Products of forests.....	9.0
Products of animals .....	2.4
	<hr/>
	74.5
Manufactures .....	17.3
Miscellaneous .....	4.1
L. C. L. height.....	4.1
	<hr/>
	100.0

1919 REVENUES PER LOCOMOTIVE DAY

28 Freight .....	\$151.82
29 Passenger .....	50.35
30 Mail .....	2.46
31 Express .....	5.46
32 All other transportation.....	5.42
33 Incidental .....	5.65
34 Joint facility, Cr.....	.31
35 Joint facility, Dr.....	.09
	<hr/>
36 Railway Operating Revenues.....	\$221.56

As against these revenues of \$221.56 there were:

EXPENSES OF OPERATION

37 Maintenance of Way and Structures.....	\$32.52
38 Maintenance of Equipment.....	53.07
39 Traffic .....	2.07
40 Transportation .....	94.32
41 Miscellaneous Operations .....	2.14
42 General .....	5.49
43 Transportation for investment.....	.29
	<hr/>
44 Railway Operating Expenses.....	\$189.90
Equipment expenses .....	\$117.47
	<hr/>
Total expenses .....	\$307.37



Actual expenses exceed revenues by  
\$84.81 daily.

For all locomotives this amounts to  
\$5,436,321 daily,  
\$1,984,106,713 yearly.

## The Estimates Can Be Checked

The estimates of expenses can be rechecked. Is the valuation of \$300,000 per locomotive an over-valuation? If it is, in what items? Is \$20,000,000,000 an over-valuation for road, equipment and supplies, including cash?

Are the capital charges of 14 per cent. over-estimated? Six per cent. interest is below the current rate. What other items are too high? Are not taxes and rentals rising, has not the cost of replacement been doubled in the last five years?

Is it not highly probable that the volume of traffic will be less in 1920 than in 1919?

As this great loss cannot immediately or for many years to come be met by increased tonnage, it has either to be endured or to be mitigated by higher rates or by greater economies.

The 6 per cent. on valuation amounts to a daily locomotive charge of  
\$49.31.

Therefore, if all investment values should be wiped out, if no inherent charges had to be paid, there would still be a deficit of \$35.50.

Confiscation of private property does not yield large revenues for state ownership nor for increased wages. The obvious remedy for the shortage is increased rates.

The petitioners have asked an increase averaging 30 per cent on freight rates. Freight rates yielded in 1919, \$152.00.

30 per cent. on \$152.00 per locomotive day	
amounts to .....	\$45.60
As the deficit was .....	\$84.81
There would still be a shortage of .....	\$39.21



## CHAPTER V.

### Suggested Increase Too Small

I regret that the petitioners asked for so little as 30 per cent. increase. Even 50 per cent. would not have been sufficient to meet the real shortage.

The general fact that both materials and wages have increased 100 per cent. since 1914 would justify a similar increase in freight rates.

In asking for so little as 30 per cent. the railroad executives must have relied on possible economies and gains from coordination to make up the balance of the shortage:

Per locomotive day .....	\$	39.21
Per locomotive year.....	\$	14,310.65
Daily for all locomotives.....	\$	2,513,361.00
Yearly for all locomotives.....	\$	914,106,000.00

While great losses and wastes occur in all American business, therefore also in the operation of American railroads, while economies are possible and expense reductions possible from increased coordination it will prove exceedingly difficult to save  
\$39.21 per locomotive day.

It is, however, legitimate to make an analysis of operations, to standardize them and to compare them with the actual.

### How a Ship Is Planned

When the keel of a new large ocean steamer is laid various facts are known in advance.

- (1) The exact cost of the completed ship.
- (2) The carrying power.
- (3) The draft.
- (4) The speed.
- (5) The exact coal consumption per hour for each speed and draft.



- (6) The other materials needed daily and their cost.
- (7) The duties to be performed by each man.
- (8) The kind of man required.
- (9) The rate of wages necessary to secure him.

Similar definite and minute adjustments have never been made as to railroads.

Many thousand investigations in industrial shops have shown that owing to lack of correlation and co-ordination the labor costs (not wages) are generally 30 per cent. too high and that materials for upkeep and maintenance are also at least 30 per cent. too high.

### **Railroads More Efficient Than Industrial Plants**

For various reasons, chiefly that they work all the time, railroads are more efficient than industrial plants. In the all-important matter of the safe carriage of freight and passengers and promptness of deliveries they are far superior to industrial plants. On the other hand, the widely scattered operations and the large proportion of maintenance work adds to the difficulties of standardized operation.

### **Standards Should Be Set**

If railroad operating units of men and machines are as uncoordinated as those of manufacturing plants, and if, as in the case of certain manufacturing plants, they could be brought up to standard, the standard expenses would be as follows:

Equipment costs .....	\$117.47
Personnel costs .....	\$100.00
Material costs .....	\$48.23
	<hr/>
	\$265.70

To attain such a standard would require years of consistent and insistent investigation of all operations, the determination of and acceptance of innumerable detail standards and wise policies that would induce all concerned to strive for the attainment of the standards.



If we assume revenues to have increased by \$45.60 to \$267.16 and operating expenses to have been decreased to \$265.70 and if nothing else had happened to increase expenses or lessen revenues the railroads would be able to earn the meagre 6 per cent. which the law allows on actual values.

Instead, however, taking the actual losses in industrial plants as applicable also to railroads and assuming that railroads could work up to standards in the same way that certain industrial plants have done, it is more practical to study the sample railroad on its own merits.

### Men Required for One Locomotive

How many men are necessary to operate one locomotive for one day? Or, to put it in a different way, how many man hours are necessary each day to operate one locomotive?

	Men	Hours	Cost
To operate the train.....	5.	37.5	\$ 26.00
To work on yards, stations.....	4.8	34.	\$ 18.75
To keep locomotive in repair.....	5.	31.5	\$ 18.80
To keep cars in repair.....	5.	31.5	\$ 18.80
Maintenance way and structures....	6.	44.	\$ 17.50
To keep records, office men.....	3.5	24.8	\$ 12.95
To seek traffic .....	.1	.7	\$ .55
To supervise and direct.....	.3	2.3	\$ 2.95
General employes .....	.3	2.2	\$ .85
	30.	208.5	\$117.15

All the locomotives of similar average weight of different companies for the same wage rates have been maintained over a whole year for a labor cost of \$8.05.

All the cars have been maintained also for a daily labor cost of \$8.10.

Maintenance of Ways and Structures have been taken care of for \$9.00 per locomotive.

These costs occurred, of course, under exceptional managers who might at the present time find difficulty in duplicating them, although in their own days they were, as to unit costs, often 30 per cent. to 50 per cent. below others.



The costs per train crew are fixed. The variable in this case is the miles the train runs. A daily run of 100 miles would lessen unit costs 25 per cent. without affecting wages and should not affect hours.

### **The Fireman Works Hardest**

Would it impose an undue strain on the fireman if he fired for 100 miles instead of 75 miles?

The fireman now averages 6.3 tons of coal in a day of 7.5 hours, at a cost of \$0.80 a ton. About one-tenth of the locomotives are oil fired and another tenth have stokers. Nevertheless the fireman's job is the hardest on the road.

Many investigations have shown that between coal mine and ash pit 56 different coal wastes occur. It would be difficult but possible to reduce coal consumption 20 per cent., thus enabling the fireman on the average to make his 100 miles without firing more tons of coal than now. The actual average work should not be increased.

Railroad men have long protested against the numerous fruitless records they have to maintain. Three and five-tenths men, working 24.8 hours daily to keep the records for one locomotive, 36 cars, and 5.7 miles of track, seems on the face of it a generous allowance. There is, in fact, no question that records could both be improved and simplified, so as to be more useful at less cost. A study of exactly what these men did daily would be worth while. An extensive study of railroad records made by a man who had spent a long and intelligently active life at railroad work indicated that office expenses could be reduced at least one-third.

### **Traffic and General Direction**

It is not usual, either in superior life or in successful industry for the directing brain to constitute so small a proportion of the whole. The big monsters formerly inhabiting the earth have all perished. They had enormous bodies but very small brains.

I am informed by the highest authorities that some of these big creatures weighing 3,000 pounds had



only 1.5 ounces of brain, and not of very good quality at that.

There are two genuses of animals on earth today, each of whose members has a relatively large brain in proportion to total weight. Both these genuses have spread all over the earth and have survived all kinds of disasters. One of the genuses is man, whose brain is 2 per cent. of his total weight; the other genus is the ant, whose brain is relatively larger and of very much finer texture than that of man.

In industrial life those enterprises have proved most successful which were most intensively directed.

Does it seem reasonable that an organization using \$300,000 of invested values, spending \$68.90 daily for materials and coordinating 30 men, should only require 2 hours and 30 minutes of directing intelligence daily?

This directing brain cost in railroad operation is less than 1 per cent.

#### **The Traffic Department—**

This department is small because so much of the business is automatic, comes of itself. Nevertheless, as the great need of the railroads is a larger volume of business per dollar invested, the traffic department seems small, considering the inroads that have been made on the railroad field by pipe lines, by trolleys, by motor trucks, by automobiles, and now a new competitor, the airplane, is beginning to encroach.

I learn that \$750,000 a day, or \$11.70 per locomotive day, is now being spent because manufacturers are delivering, under their own power, automobiles they would much prefer to ship by rail. This \$11.70 would add 5 per cent. to railroad revenues with greater satisfaction to all concerned.

### **What Is the Efficiency of the Railroads?**

Whether the general efficiency of co-ordination of railroad employes is 70 per cent., 80 per cent., 90 per cent., no one knows. It varies according to the skill and ability of the management. Even if it were as



high as 80 per cent. it would take at least five years of hard, conscientious and competent work to remove the difficulties and to attain 100 per cent.

- (1) It is not efficient co-ordination to make wholesale discharges of men. The wrong men are apt to be discharged. Moreover, it is never necessary. A percentage of men, usually the least desirable, drift away each year; they cannot be held; they are replaced with men even less desirable.
- (2) It is highly undesirable to force new methods, however good, too quickly on executives. A repaired road is often rougher to drive over than the unrepaired road, but it smoothes down in time.
- (3) The losses are not usually caused by materials and by workers, but by unco-ordinated conditions which the executives alone can palliate if they are beyond immediate remedy.

## MATERIALS

Materials generally offer the most fruitful field for economy.

The analysis of materials shows that two items, fuel and locomotive repair parts, constitute a little more than half of the total material expense. Four more items, ties, track supplies, stationery and track material amount to 12.7 per cent. more. These six items make up 63 per cent. of the cost of all materials. Where intensive supervision has been exercised over any one of these items it has been possible to reduce the cost not less than 20 per cent. Sometimes as much as two-thirds. Such economies depend on the willingness to take the trouble to control details.

It is a fact often noticed that some of the small roads of the country maintain locomotives, cars and line for much lower unit costs than the larger roads. The reason is that more intensive supervision is possible if the officials in charge are able, and this intensive supervision brings down costs.



## **The Answer**

In the earlier part of this story the question was asked as to what the effect would be on the diameter of a tire 24,000 miles around if it were lengthened one foot. The trick of this question lies in putting in the words 24,000 miles long. It makes no difference whether the tire is 24,000 miles around or 24 feet around or 24 inches around. The diameter is always about one-third of the circumference, and if I put in a piece one foot long I have lengthened the diameter nearly 4 inches, so that it would take a shim all the way around nearly 2 inches thick to tighten it.

## **Cost Reduction Can Be Brought About**

From this brief survey of both personnel and material expenses it appears that worth-while reductions in cost could be gradually brought about.

I am certain that even with best economical and efficient management the reductions cannot make up the deficits now occurring.

## **Increase Should Be Granted**

Nevertheless granted rate increases and consistent cost reductions, both working to the same end, will make the situation better than it has been for many years.



# APPENDIX I.

## Inventories Miles of track

Main line .....	3.60
2nd and 3rd tracks.....	.55
Tracks in yards and sidings.....	1.55
	<hr/> 5.70

## Estimate of cost of road by W. C. Nisbet

	Per mile of line	Per mile of track	
Right of way.....	\$ 1,500	\$ 948	
Grading .....	\$ 5,000	\$ 3,160	
Fencing .....	\$ 600	\$ 379	
Rails .....	\$12,000	\$ 7,584	
Ties .....	\$ 5,000	\$ 3,160	
Track fastenings .....	\$ 3,500	\$ 2,212	
Ballast .....	\$ 2,000	\$ 1,264	
	<hr/>	<hr/>	
Road .....	\$29,600		\$18,707
Bridges, trestles, culverts..	\$ 2,000	\$ 1,264	
Signals, interlockings .....	\$ 1,500	\$ 948	
Telephones, telegraphs....	\$ 1,500	\$ 948	
Tunnels .....	\$ 500	\$ 316	
Ferries .....	\$ 500	\$ 316	
Snow sheds .....	\$ 100	\$ 63	
	<hr/>	<hr/>	
Accessories .....	\$ 6,100		\$ 3,855
Terminal stations .....	\$ 3,500	\$ 2,213	
Road .....	\$ 2,000	\$ 1,264	
Miscellaneous buildings....	\$ 800	\$ 505	
Shops and roundhouses....	\$ 1,600	\$ 1,011	
	<hr/>	<hr/>	
	\$ 7,900		\$ 4,993
	<hr/>	<hr/>	
Total fixed .....	\$43,600		\$27,555

This estimate of reproduction cost gives a higher valuation for fixed investment than the valuation used. Per locomotive in service it amounts to \$153,-360, while the valuation used sums for the fixed investment to \$137,000.

## One Locomotive

Weight on drivers in tons.....	73
Tractive power in pounds.....	33,350
Appraised value .....	\$45,000

## One Combination Coach

Value .....	\$20,000
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## 36.4 Freight Cars

Value per locomotive.....	\$80,000
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Kind of car	Number	Tons Capacity Each	Tons Total Capacity
Box .....	16.3	36.3	591.7
Coal .....	14.5	47.6	690.2
Flat .....	1.7	37.7	64.1
Stock .....	1.4	32.4	45.4
Other .....	1.4	45.2	63.3
Refrigerator .....	.9	32.5	29.3
Tank .....	.2	40.5	8.1
	36.4	41	1,491.1

#### Other Equipment Value per Locomotive

Work equipment, as steam shovels, snow plows, ditchers, work cars, also shop equipment, general, machine tools, shop tools..... \$3,300

The estimates for some of these items are unreasonably low.

#### Stores and Supplies

(This item is taken directly from Interstate Commerce Commission records)..... \$9,900

#### Working Capital and Cash

(This item is also taken from Interstate Commerce Commission records)..... \$4,800

The valuation reports of the various groups of roads equated to 1920 prices indicates that they will exceed the total of \$300,000 for each locomotive by several billion dollars.

## APPENDIX II.

### COMPARATIVE VALUATIONS IN 1913 PER MILE OF LINE

CONSECUTIVE No. 100

MISCELLANEOUS SERIES No. 25

COMPARATIVE RAILWAY STATISTICS

UNITED STATES

AND

FOREIGN COUNTRIES

1913

BUREAU OF RAILWAY ECONOMICS

1. Western Australia .....	\$26,080
2. China (1912) .....	32,900
3. Sweden (1912) .....	33,940



4. Queensland .....	35,360
5. Siam .....	40,100
6. Norway .....	43,720
7. India .....	46,340
8. Australia .....	47,040
9. Bulgaria (1911) .....	47,130
10. Chile .....	48,265
11. Union of South Africa .....	48,265
12. New Zealand .....	55,035
13. Algeria and Tunis (1911).....	55,110
14. Canada .....	56,605
15. Denmark .....	61,400
16. Victoria .....	63,470
17. United States .....	65,869
18. Mexico .....	68,360
19. Hungary (1912) .....	71,230
20. New South Wales .....	71,390
21. Russia (1910) .....	86,970
22. Japan .....	88,633
23. Spain (1909) .....	89,350
24. Roumania (1912) .....	90,090
25. Germany .....	120,050
26. Austria .....	122,505
27. Switzerland .....	129,600
28. France (1912) .....	150,440
29. Belgium (1912) .....	216,140
30. United Kingdom .....	274,030

As these lines are of different gauges, some single, some double, some more, in countries varying greatly in topographical difficulties and in development, comparisons are not of much value.

The capitalization for the United States is only one-quarter that of the British lines. Victoria and the United States have the same number of miles (26) per 10,000 population. The lines cost very nearly the same.

The operating ratios in 1913 runs from 35.44 for Siam to 88.85 for Chile, the United States being 69.4, the same as Belgium.

### APPENDIX III.

#### THE SEVEN INVESTMENT CHARGES

(1) Taxes. If these are not paid the delinquent property is subjected to heavy penalties and ultimately confiscated. Taxes are the one charge a public utility



investment might be rationally spared. To tax on the one hand and to impose heavier rates in order to earn enough to pay taxes is robbing Peter to pay Paul. This is, however, one of the penalties we pay for our (in so many respects) admirable plan of local self-government, each with its taxing power.

(2) Insurance. This is an investment maintenance charge, but, for accounting reasons, the Interstate Commerce Commission has distributed insurance premiums to the different operating sections and they thus become an operating instead of an investment charge. Railroad insurance is not heavy. The risks are scattered. It would be less expensive to pay losses than to pay premiums.

(3) Uncollectible Railroad Revenues. Why these should not be charged back to the class of revenue originally credited I do not know. Under the plan adopted railway operating revenues, in extreme cases, might be made to make an unduly favorable showing. If the failure to collect is not charged to operation it must be charged to maintenance of investment.

(4) Rentals. These are straight investment charges. If rents are not paid, capital would have to be invested, causing an increase in all investment charges except rents.

(5) Obsolescence. Obsolescence is an investment charge which has been inadequately and insufficiently provided for in the past. It has been occasionally taken care of by tremendous scalings down of values, after receiverships or reorganizations, sometimes by assessments against the shares.

Obsolescence is wholly different from the wear and tear, which can be made good by repairs. Depending as it does on human judgment, making estimates for the future, it is particularly liable to error. The seller minimizes it, camouflages it, the buyer says nothing about it, but slashes the whole value. The manager who is to meet rising costs, to maintain current repairs, to please the public, to earn dividends, hates such a charge as obsolescence. The able president of a great railroad supply corporation objected



strenuously to a monthly charge for obsolescence. When he had a good year with large profits, he wrote off values before carrying operating profits into the income statement. When times were hard he refused to burden an already hard-pressed statement with obsolescence charges. He was practically right, but theoretically wrong. Railroads are not private businesses and should show their real expenses, including probable obsolescence, monthly. Obsolescence is insidious, but it should not be shoved ahead onto a successor. Obsolescence is akin to the fraying of a collar, to last year's bonnet, to a little used automobile of 1910. It is like the well-fed horse who ultimately dies of old age. Provision has to be made for his replacement. It is exceedingly dangerous to capitalize obsolescence; as when the new locomotive, bought to replace the old one, worn out, or largely worn out, is charged to capital account.

Obsolescence varies with every class and even with every item of capital investment. It varies from year to year. Like insurance, it must be spread according to the law of averages corrected to actual past experience.

The obsolescence figures used have been adopted after consultation with many authorities and are based on wide experience: It is the method which is important, not the actual figures used, as these are subject to revision and amendment as additional facts become known.

#### OBSOLESCENCE ESTIMATES

	Average Life in Years	Inven- tory Value	Yearly Obs.	P. C. in Value
Locomotives .....	15	\$45,000	\$3,000	6.7
Freight cars .....	14	80,000	5,720	7.2
Passenger cars .....	20	20,000	1,000	5.
Road .....	30	106,600	3,550	3.1
Right of Way .....		5,400		
Accessories .....	16	5,000	312	6.2
Buildings .....	30	20,000	666	3.3
Shop and work equipment	10	3,300	330	10.
Stores and supplies .....	20	9,900	495	5.0
Working capital .....		4,800	.....	....
		<hr/> \$300,000	<hr/> \$15,073	<hr/> 5.
Daily Obsolescence Charge .....				\$41.09



The inventory values may be briefly justified. A committee of railway executives (p. 3, *Increases of Revenues of Railroads in Western Classification Territory*, before the Interstate Commerce Commission, May, 1920,) has estimated:

Freight cars to cost.....	\$ 3,700
Locomotives to cost.....	\$65,000
Passenger cars to cost.....	\$30,000
Baggage cars to cost.....	\$20,000

The rate of obsolescence may also be briefly justified. When we assume that all freight cars average 14 years, it means that some last 28 years or more, but that others have the misfortune to be destroyed very early in their service.

As to freight cars, we remember that in the last five years the old wooden cars became obsolete, not because they were worn out but because they were no longer strong enough to stand the strain of increased train loads and of being bumped by the heavy steel cars and the heavy locomotives. No one yet knows the average life of a modern steel car. It will depend on design, construction, quality of steel and of paint, on kind of load and on running repairs as well as on service.

The great American locomotive shops build about 6,000 locomotives yearly; while some are exported and some go into new equipment, the larger number are for replacements. The old locomotives are not worn out—they become too small or uneconomical to operate. The heavy modern weights and high steam pressures add to the rapidity of ultimate destruction. An estimated life of 15 years would require an average of 4,270 replacement locomotives a year.

As to passenger train coaches, I was advised by the highest authority, an official of the Pullman Car Company, not to count on more than 20 years.

There are Roman bridges that have lasted for centuries, but modern railroad bridges have to be replaced because not strong enough. The Quebec Railroad Bridge went down before it was completed. It would take a heavy yearly obsolescence charge for many years to make up the loss.



A few years ago the San Pedro road was put out of operation for many months by a series of wash-outs which cut the line off at both ends. The capital charges went on just the same—in fact to greater degree, since the misfortune led to the relocation of the survey, the rebuilding of the road over many miles. After all the losses and all the improvements it was still a road of the same capacity.

Shortly after 1903 nearly all shop machinery was made obsolete by the changes to high-speed tool steel, and also by the desire to use electrical individual drives. Machine tools are not like locomotives; they cannot be indefinitely repaired; they cease to be accurate.

Certain amounts called depreciation are now included in operating expenses. What is deterioration, what is depreciation, what is obsolescence? A man invited a friend to take an afternoon ride in a \$5,000 automobile. When they returned he said: "That is the most expensive ride you ever took. When we started the car was new, worth \$5,000; now it is second-hand, worth only \$2,500." This was not deterioration, for the car was in perfect condition. It was not obsolescence, for the car was still an up-to-date newest model car. In this sense mended, patched locomotives and cars have suffered depreciation, they would not sell for the same price as new, yet they may be better, even as a well-broken 6-year-old horse may be worth more than he was as a 4-year-old untrained colt. There is only one real way to determine depreciation and obsolescence, and that is to appraise the present values of the property on the basis of its performing value.

It will always have a minimum value as scrap. It may have a higher value than its replacement value. "My kingdom for a horse," said the defeated king.

All in all, a yearly 5 per cent. obsolescence charge seems to me rational and conservative. What remains today of properties operating 20 years ago?

A 10 per cent. a year obsolescence charge against the diminishing value would leave a scrap value of 12 per cent. at the end of 20 years. Obsolescence



can be estimated in advance and allowances be set up for temporary use, but the only way actually to determine the amount of obsolescence is by reappraised inventory.

There is a further consideration. Four locomotives were bought 13 years ago for \$0.08 a pound. These locomotives now have to be replaced. A new one just like them would cost \$0.25 a pound. If we had theoretically set aside an obsolescence of 6.25 per cent. we would have on hand only enough to buy one new locomotive. But we need four! Shall three of the four new ones be capitalized and an investment charge of 14 per cent. on their value be added into future rates, or would it have been fairer to have increased obsolescence charges while the locomotive was still working?

Why should Yesterday throw upon Tomorrow the obligation to replace the locomotive worth \$0.25 a pound which Yesterday was using up?

There is, of course, as to ties, locomotives, cars, no such thing as an obsolescence fund, growing at compound interest, any more than there is an obsolescence fund to replace coal burned. On large roads ties, locomotives, cars are used up daily and obsolescence becomes an actual daily expense. Even bridges and buildings, as a whole, cause a yearly obsolescence charge; the money has to be reinvested yearly.

#### (6) Unremunerative Betterments—

There is an expense more insidious, even, than obsolescence to which, to date, little consideration has been given. As the name implies, an unremunerative betterment is one that costs much but which yields no income. Passenger rates have been nearly the same since railroads started in the United States. In many instances rates have fallen. Freight rates have steadily fallen. Yet what betterments, unremunerative to the railroads, have occurred in passenger traffic!

Double tracking  
Heavier rails



Stupendous terminals and beautiful stations and grounds  
Elevated tracks  
Great bridges  
Air brakes  
Steel coaches  
Steam heating  
Electric lighting  
Electrified terminals  
Sumptuous fittings  
Frequent service  
Through trains  
High speed  
Block and other safety signals and devices.  
Dining car service

Even at half the rates passengers would grumble today if forced to travel in the way my father did between 1840 and 1860. I would grumble at traveling the way I did between 1860 and 1890. My children would grumble at traveling now the way they did between 1890 and 1910.

Railroads have made the mistake of capitalizing unremunerative betterments, yet submitting to the same rates.

The public wants better service and should have it, but should pay for it currently, not confiscate its capitalized cost from the railroad investors.

The vicious reasoning and practice has been:

Existing service is as good as the rates justify!

The public demands better service!

The public refuses to pay higher rates!

Therefore add the better equipment but capitalize its cost!

As earnings are not increased the net earning rate becomes less when distributed to a larger investment!

The rate of return declining, the share or bond value falls!

The man who paid \$1,000 for bond or shares can market them for only \$700!



It is the railroad investor who suffers the loss!

The railroad investor be damned!

Let the Government operate the roads and tax other capitalists to make up the deficit!

It is probable that in the past 60 years the amount of unremunerative betterments charged to capital but which should have been charged to investment expenses is about 2 per cent. per annum.

It is an interesting fact that of all the different forms of material activities, Transportation has the heaviest capitalization in proportion to income. Whereas some very large producing plants turn over their capital several times a year (i. e., the gross income in a year is several times the investment), in railroads, in 1919, gross income was only one-quarter of gross value. It was not always so. I have known railroads in frontier regions, with thin traffic, to pay for their cost in the first three months of operation, yet they were considered public benefactors.

No one can foresee what amount of unremunerative betterments will have to be installed by railroads in the future in order to satisfy an increasingly exacting public. It may take the form of eliminating grade crossings, or of elevating tracks through cities, or of suppression of smoke, or of electrification, or of subways through cities, or of central terminals. Twenty years ago few could foresee the substitution of steel for wood in coaches and cars, or the doubling of rail weights, etc., etc.

In the past it has proven necessary to prohibit managers from capitalizing operating expenses.

It may now be necessary to require that unremunerative betterments to old investment shall be carefully segregated from what is unmistakably new development.

The engineering manager of the \$300,000 road with its single locomotive would probably want to spend at least \$9,000 a year on unremunerative betterments, and expect to meet the expense out of rates, but, to be conservative, I put the amount at \$6,000, or 2 per cent.



These five unescapable kinds of capital expenses—taxes, insurance, rentals, obsolescence, unpaying betterments, impose a burden of 6.3 per cent. a year. There remains the interest rate.

#### (7) Interest Rate—

Congress, in Section 15a of the Interstate Commerce Act, as amended by the Transportation Act of 1920, provides:

“In the exercise of its power to prescribe just and reasonable rates the Commission shall initiate, modify, establish or adjust such rates so that carriers as a whole will, under honest, efficient and economical management and reasonable expenditures for maintenance of way, structures and equipment, earn an aggregate annual net railway operating income, equal as nearly as may be to a fair return upon the aggregate value of the railway property of such carriers held for and used in the service of transportation; Provided that during the two years beginning March 1st, 1920, the Commission shall take as such fair return a sum equal to 5.5 per centum of such aggregate value, but may at its discretion add thereto a sum not exceeding one-half of one per centum of such aggregate value.”

The railroads with the highest credit in the world, the Pennsylvania and the Union Pacific, are paying 7 per centum for bonds.

Six per cent. is not therefore a fair rate; it is not high enough to attract capital either to renew maturing securities or to make extensions and additions. Nevertheless for purposes of estimate the 6 per centum rate will be used. This amounts to \$49.32 a day. It is the third largest charge, being exceeded only by Transportation expenses and Maintenance of Equipment.

At one time I held that it might be desirable for the Government as an equivalent for its assumption of arbitrary powers over operation to lend the railroads its credit, issuing 4 per cent. bonds but charging the railroads in addition a 1 per cent. amortization.



This would have wiped out the present railroad debt in 40 years. It would have reduced capital charges \$3,000 a year.

The Government is no longer able to do this. It has exhausted its own credit by the extensive Liberty Bond issues and it cannot maintain its own securities on a 6 per cent. basis.

#### APPENDIX IV.

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### TWO SUGGESTIONS AS TO THE RECORDS OF THE INTERSTATE COMMERCE COMMISSION

A good record must have many qualities.

The first and most important is that it should be necessary.

The next is that the necessary or essential facts should be recorded.

The third essential is that the records should be prompt. Prompt and approximate is worth far more than dilatoriness but accuracy.

The fourth essential is reliability, at least approximate reliability.

The fifth that they should be classified.

The sixth that they should be summarized.

There are about twenty other qualities valuable, but not as important as these.

When I first began making a study of railway reports about 20 years ago there was very little that was comparative or accurate. Each railroad was a law unto itself. The grossest abuses existed. Operation was charged to capital investment, and vice versa. Immense amounts were arbitrarily and for reasons of short-sighted expediency, transferred from one account to another.



I appreciate the immense and valuable and intelligent work done by the Commission and its able officers in introducing order and systems; in making everything comparative; for its splendid summaries.

Nevertheless, in two respects the records are open to severe criticism.

(1) Records that should be available monthly are not published for four to five years.

(2) Much that is absolutely and basically essential is not there.

We all know without argument that weather bureau forecasts would be valueless unless they were out and in the hands of those needing them before the event forecast. To forecast a blizzard even four days after it had occurred is not more inept than to give us summaries of railroad operations four months, often four years, after the events occurred. The world has changed in four years.

The weather bureau manages to get its forecasts out promptly. Why? The Interstate Commerce Commission is four years and more behind. Why? Simply because the fact that these records four years delayed have the value for mental food of a barnyard egg four years old, has not been agitated until there was reform.

I was irritated to be told that the Public Printer was overwhelmed with work.

Why is he so overwhelmed with work as, by the delays of his bureau, to make almost valueless records that have cost millions of dollars to collect and compile, records that are needed promptly to save many more millions than they cost?

A newspaper has to collect and publish the news promptly.

The great armies abroad had to be fed daily. Because there was necessity it was met. Either give the tax-payer promptly what he pays for, or discontinue an expense that bears no fruit.



The second suggestion is that vitally essential records are not furnished. Let me make it plain by an analogy. A train is on its way between terminals. There have been no records. The accountant is asked to supply them.

He counts the cars, their weight, capacity, what they contain and the destination. All this is valuable. It does not help the engineer who wants:

A mileage table,  
A timetable,  
A watch,  
A water glass,  
A steam pressure gauge,  
A water tank gauge,  
A fuel measurer,  
A speedometer,  
Orders from the despatcher,  
Signals.

The accountant knows nothing about these all-essential records and if the matter were left to him the engineer would never get them.

What does the student of railway economics want to know as the basis of all knowledge and investigation? He wants to know:

The relative actual amounts contributed by the three elements of equipment, materials and personnel; he wants summaries and comparisons of these three, all including divisions, so that he can set up standards which should be striven for and realized.

Even if the cost of final result from the two methods is exactly the same, the moral, psychological, physiological problems are entirely different, whether we have one man and ten machines or have ten men and one machine.

Cost is not the chief thing; man is the chief thing, and we want costs in terms of men, of materials, of equipment separately, not scrambled together; so that



we can see to what extent the materials of the universe, the implements of inventive genius and the skill of co-ordination with men as supervisors can make this world a better place.



*The following pamphlets are available for distribution. The Emerson Engineers will gladly forward any of them on request:*

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THE EMERSON ENGINEERS,

30 Church Street,

New York.







*Published by*  
**THE EMERSON ENGINEERS**  
**30 CHURCH STREET**  
**NEW YORK**



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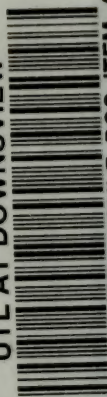
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